

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method, comprising:

applying a no-clean flux to a first surface of a substrate, the first surface of the substrate having attached thereto solder bumps, the solder bumps having a melting temperature, and the no-clean flux substantially comprising ingredients that have a volatilization temperature less than the melting temperature;

generally aligning the solder bumps with corresponding metal bumps, the metal bumps being attached to a first surface of a chip;

bringing the solder bumps into contact with the corresponding metal bumps via a thermo-compression bonder; and

heating the solder bumps to a first temperature, the first temperature being equal to or greater than the melting temperature, the solder bumps having a melting point at the first temperature, and the flux having the volatilization temperature at which substantially all of the constituents of the flux volatilize, the volatilization temperature being less than or equal to the first temperature;

placing the substrate against a first fixture, the first fixture being maintained at a second temperature below the first temperature; and

placing the chip against a second fixture, the chip having affixed thereto a plurality of metal protrusions.
2. (Original) The method of claim 1, wherein the first surface of the chip comprises copper.
3. (Currently Amended) The method of claim 1, wherein the bringing of the solder bumps into contact with the corresponding metal bumps, ~~further includes bumps~~ further comprises applying a contact force.

4. (Original) The method of claim 3, wherein the contact force is removed just after the solder bumps have been heated to at least the melting temperature.
5. (Currently Amended) The method of claim 1, wherein the solder bumps ~~are comprised of~~ comprise a 96.5% tin, 3.5% silver solder.
6. (Previously Presented) The method of claim 1, wherein the no-clean flux includes a carboxylic acid and has a volatilization temperature of approximately 200 degrees Celsius.
7. (Currently Amended) The method of claim 1, further comprising:

joining the solder bumps to the metal bumps by cooling the solder bumps to a temperature below the melting temperature;

heating the first surfaces of the chip and the substrate to within a temperature range, the temperature range being equal to or greater than the volatilization temperature but less than or equal to the melting temperature; and

maintaining the chip and the substrate first surfaces within the temperature range for a first period of time.
8. (Original) The method of claim 1, wherein the heating of the solder bumps comprises heating the solder bumps through a second surface of the chip, the second surface of the chip being opposite the first surface of the chip.
9. (Currently Amended) The method of claim 8, wherein the heating of the solder bumps to a first temperature further includes rapidly increasing the temperature of the second surface to a ~~a~~ the second temperature, the second temperature being greater than the first temperature, wherein a temperature gradient is established through the chip from the second surface at the second temperature to the first surface of the chip at the first temperature.
10. (Original) The method of claim 8, wherein the heating of the solder bumps to the first temperature comprises providing a heater in contact with the second surface.

11. (Original) The method of claim 9, wherein a third temperature at a second substrate surface opposite the first substrate surface is significantly below the first temperature, when the first surface of the chip is at the first temperature.
12. (Original) The method of claim 9, further comprises maintaining the second surface at the second temperature for a period of time.
13. (Original) The method of claim 12, wherein the period of time is approximately 1 to 5 seconds.

Claims 14-39 (Cancelled)